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(56) Documents cited

GB 1458034 A

GB 1428791 A

GB 1339505 A

GB 1017232 A

US 4248582 A

(58) Field of search

UK CL (Edition K) B5A AT15B AT15N

INT CL⁵ B29C

(54) Alternately operating blow mould pair

(57) Extrusion blow moulding apparatus includes first (4) and second (4a) split blow moulds operable between vertically raised and lowered positions by hydraulic cylinders (6, 6a), and mounted on a carrier (5), which is laterally reciprocable relative to a fixed main bed (9) of the apparatus and the parison extrusion nozzle (21), upon horizontal columns (7), by a pair of drivers (10) that emerge from both sides of a common hydraulic cylinder (11). The arrangement is such that in use the bed (5) moves laterally in synchronisation with the hydraulic cylinders (6, 6a) in order to produce alternatively the extrusion of thermoplastic material to the first mould 4 in its raised position, and the blowing and opening of the second mould 4a in its lowered position to release the formed plastic object, which in the embodiment is a plastic bottle (not shown).

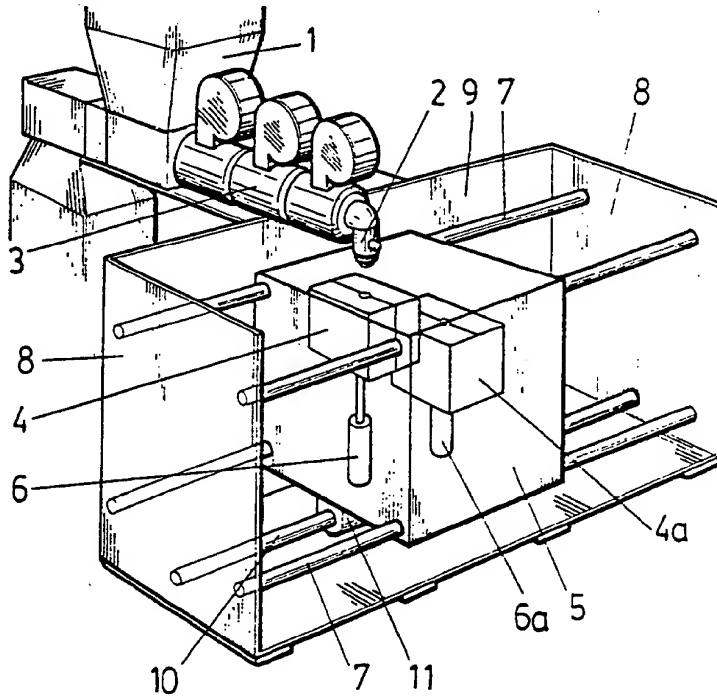


FIG. 1.

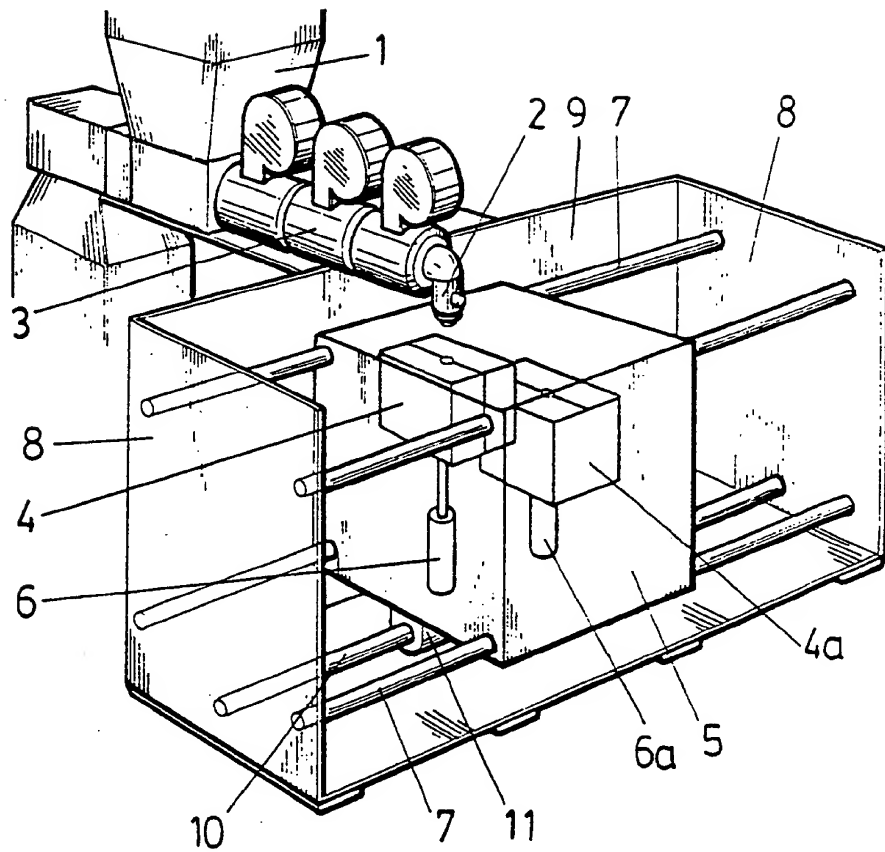


FIG. 1 .

IMPROVEMENTS IN BLOW MOULDING APPARATUS

This invention relates to improvements in blow moulding apparatus, particularly for forming bottles.

A conventional blow moulding machine usually comprises two parts, ~~the first designed to provide plasticity to the material, and the~~ second adapted to receive portions of the plastic material which is then expanded by compressed air to adopt the shape determined by a mould. In order to attain the desired degree of plasticity, the material stored in a hopper is carried by a spindle to a thermal chamber where, by means of pressure and heat, it becomes fluid. The material passes from this thermal chamber to a corresponding extrusion head of the machine. Sensors and other automatic devices are incorporated into the machine to cause cyclic repetition of the complete moulding process, with the corresponding admission, founding and extrusion operations. The material will adopt a tubular shape having a closed end so as to make possible effective blowing to reach the mould dimensions whereupon the mould is stripped away from the formed plastic object.

The above-mentioned moulds are composed of two parts, each part corresponding to one half of the object. The thermoplastic material is introduced into the moulds and retained there. Afterwards the moulds are transported to a blowing station. The moulds are provided with one or two holes to obtain the corresponding one or two objects. The number and size of the objects depends on the capacity of the machine to extrude the material in each cyclic operation.

The moulds also include a series of elements to achieve an exact centering of its two parts so as to guarantee their perfect coupling.

When the fluid material is introduced into the moulds, it is injected with compressed air, producing its expansion so that it adopts the shape of the mould and has a pre-determined thickness. The object is then separated from both parts of the mould, and is ready for use.

Both parts of the moulds are perfectly adapted and consequently their handling must be carried out very carefully. The moulds must be interchangeable in order to enable the machine to form different types of objects.

These carriers or mould holding devices must be mounted in a specific arrangement so as to enable them to be positioned under the extrusion nozzle, under the air injector, in front of the neck cutter, and finally so as to allow the stripping and freeing of the object.

The above movements in position might be performed in synchronization according to an automatic predetermined and repeating cycle, presently this synchronization is achieved by means of automatic devices based on micro routines, relays, keeps, cams, stops, etc., and also by microprocessors. It is possible to use two types of sources to activate the motor and the circuits. One of them based on hydraulic energy and the other based on pneumatic energy, both combined with electricity.

A bottle moulding machine of the above kind is described in Spanish Patent number 8901181 which claims means to activate or move the mould holders to achieve a specific action, the devices being mounted on a bed, forming part of the main bed with two hydraulic cylinders, one of them to open and to close the mould holders and the other to carry out their movements.

The aforesaid devices are structurally based on a pair of axles actioned simultaneously by the hydraulic cylinder which also provides them with synchronized radial movement, allowing the machine to activate simultaneously and alternatively two mould holding devices with only one system.

In the above system the maximum production is reached using moulds with two holes, allowing the production of 2,000 bottles per hour, each bottle having a capacity of one and a half litres. Consequently the machine proposed by the Spanish patent No. 8901181 has a mechanical limitation related to the system of the oscillating arms since it is impossible to improve the rate of production, as the rate of carrying the complete process of introduction blowing and stripping is fixed.

It is an object of the invention to overcome this disadvantage of the prior art.

According to the invention there is provided blow moulding apparatus comprising a hopper for storing a thermoplastic material, a heat and compression chamber for fluidising the thermoplastic material, an extrusion nozzle connected to the chamber for extruding the thermoplastic material, first and second split moulds operable between raised and lowered positions and mounted on a carrier positioned above a main bed of the apparatus and movable transversely between opposing sides of the main bed, means for raising and lowering said moulds up to and down from the extrusion nozzle so that in use the carrier moves, transversely to the left or to the right in synchronism with said raising and lowering means, in order to produce alternately the extrusion of a thermoplastic material to the first mould when said first mould is in its raised position, and the opening of the second mould to release the finished object when said second mould is in its lowered position.

The mobile carrier may comprise blow moulding apparatus in which the carrier comprises a mobile bed which is mounted on horizontal columns fixed at their ends to opposing sides of the main bed, which sides also support the distal ends of a pair of drivers connected at their proximal ends to a common hydraulic cylinder located under the mobile bed.

The means for raising and lowering said moulds may comprise supporting said moulds on two vertically positioned hydraulic cylinders which are movable upwardly and downwardly in use.

Apparatus embodying the invention as hereinafter described, by way of example, with reference to the accompanying drawings.

Fig.1 shows a perspective view of a blow moulding apparatus in accordance with the invention.

Referring to the drawing there is shown blow moulding apparatus comprising a hopper 1 for storing thermoplastic material, which is transported from there to an extrusion nozzle 2, after its passage through a heating and compression chamber 3 for fluidising the thermoplastic material. The apparatus includes first 4 and second 4a split moulds operable between raised and lowered positions and mounted on a laterally movable carrier which is positioned above and movable relative to a fixed main bed 9 of the apparatus, the movable carrier being in the form of a mobile bed 5 which is guided by and mounted on horizontal columns 7 fixed at their ends on opposing sides 8 of the main bed 9, which sides 8 support a pair of drivers 10, that emerge from both sides of a common hydraulic cylinder 11, located under the mobile bed 5. The means for raising and lowering the first 4 and second 4a moulds up to and down from the extrusion nozzle 2 comprise first 6 and second 6a cylinders hydraulically activated and vertically arranged to provide the moulds with upward and downward movement. The arrangement is such that in use the bed 5 moves laterally in synchronisation with the hydraulic cylinders 6, 6a in order to produce alternatively the extrusion of thermoplastic material to the first mould 4 in its

raised position, and the opening of the second mould 4a in its lowered position to release the formed plastic object, which in the embodiment is a plastic bottle (not shown).

It can be seen that when the mould 4 receives a parison of thermoplastic material through the extrusion nozzle 2, the mould 4a is closed, and once the mould 4 leaves its raised position under the extrusion nozzle 2, its corresponding hydraulic cylinder 6 retracts producing a lowering movement of the first mould 4, and synchronously, the mobile bed 5 moves towards its left side as viewed in Fig.1, driven by the cylinder 11 of the double driver 10.

During the downward movement of mould 4 and the lateral left movement of the mobile bed 5, there is simultaneous upward movement of mould 4a to achieve the raised position up to the extrusion nozzle 2, for receiving in turn a parison of thermoplastic material.

During the downward movement of mould 4 the blowing means incorporated in it expand the thermoplastic material.

The above described movements of the moulds 4 and 4a and the mobile bed 5 occur in cycles, that is to say, when the first mould ascends, the second descends, and the lateral movement of the mobile bed is carried out simultanelously to one side or the other side according to the ascending or descending movement of the respective mould. The mould opens to release the formed plastic object during its descending movement.

In this way both moulds work alternately with short, rapid and precise movements providing a simple improvement over the prior art. This alternate movement of the moulds, when carried out rapidly has in tests provided an efficiency improvement of 50% on apparatus according to the Spanish patent No. 8901181, that is to say, it is possible to obtain 3000 bottles per hour.

CLAIMS

1. Blow moulding apparatus comprising a hopper for storing a thermoplastic material, a heat and compression chamber for fluidising the thermoplastic material, an extrusion nozzle connected to the chamber for extruding the thermoplastic material, first and second split moulds operable between raised and lowered positions and mounted on a carrier positioned above a main bed of the apparatus and movable transversely between opposing sides of the main bed, means for raising and lowering said moulds up to and down from the extrusion nozzle so that in use the carrier moves transversely to the left or to the right in synchronism with said raising and lowering means, in order to produce alternately the extrusion of a thermoplastic material to the first mould when said first mould is in its raised position, and the opening of the second mould to release the finished object when said second mould is in its lowered position.
2. Blow moulding apparatus according to claim 1, in which the carrier comprises a mobile bed which is mounted on horizontal columns fixed at their ends to opposing sides of the main bed, which sides also support the distal ends of a pair of drivers connected at their proximal ends to a common hydraulic cylinder located under the mobile bed.
3. Blow moulding apparatus according to Claim 2, the means for raising and lowering said moulds comprising supporting said moulds on two vertically positioned hydraulic cylinders, which are movable upwardly and downwardly in use.
4. Blow moulding apparatus, substantially as hereinbefore described with reference to the accompanying drawings.

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Patents Act 1977
Examiner's report to the Comptroller under
Section 17 (The Search Report)

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Relevant Technical fields

(i) UK CI (Edition ^K) B5A: AT15N; AT15B

(ii) Int CI (Edition ⁵) B29C

Databases (see over)

(i) UK Patent Office

(ii)

Search Examiner

A J M TAJASQUE

Date of Search

18.09.91

Documents considered relevant following a search in respect of claims 1-4

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X X GB	GB A 1458034 (INCOPLAN) - see features 24, 26, 28	Claim 1 at leas
X	GB A 1428791 (ETHYL) - page 3 lines 45-75	" "
X	GB A 1339505 (RHEIN MET ALL) - page 2 lines 13-39; fig 4	" "
X	GB A 1017232 (WARD) - page 1 lines 26-37 and 60-65; figures 1 & 4	" "
X	US 4248582 (ROMAN) - column 3 lines 12- 5, and 49-58; column 5 lines 10-19	" "

SF2(p)

1ms - c:\wp51\doc99\fil000036

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family, corresponding document.

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).